

# **Wireless point-to-point communications using forward scatter propagation from the Equatorial Electrojet**

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## ***Abstract***

The statistical analysis and conclusions from experiments conducted by Cohen and Bowles in 1963, Romero et al. in 1968, and Valladares and Woodman in 1975, suggested the possibility of exploiting VHF scatter propagation for equatorial communication circuits. Even more, the use of weaker, faster fading night-time signals for telecommunications may also be feasible.

The focus of this paper is the potential of employing ionospheric (EEJ) forward scatter propagation for VHF communications. For this purpose, a VHF radio-link has been recently setup between Jicamarca and Paracas (~200 Km to the south of Jicamarca), in Peru. The ultimate object of this effort is to evaluate the use of the Equatorial Electrojet (EEJ) as the dispersion media for wireless point-to-point communications.

A matlab simulation program has been used to characterize the communication channel as well as to test different modulation and configuration schemes. Numerical model for the EEJ, as well as frequency and phase modulators and demodulators have been implemented within the scope of this program. The results from the simulation studies have been used to design the test-link between Jicamarca and Paracas.

The point-to-point VHF communications system used for this investigation consists of two transmit-receive stations using 100W transceivers and 50 MHz Yagi antennas. Each transmit-receive station also includes a digital input and output connection that can be used to send and receive voice and data to and from a portable PC; e.g. for off-line analysis. One of these stations is installed at the Jicamarca Radio Observatory (JRO), while the second station was first installed in Lima in 2003, and then relocated in Paracas in 2004.

Several experiments have been conducted using both, the Jicamarca-Lima and Jicamarca-Paracas radio links for VHF communications, as well as the JRO's 50 MHz radar for EEJ observation. These combined experiments allow determination of the correlation between the voice communication's intelligibility and the intensity of the EEJ radar echoes. In addition, the H magnetic components from the Jicamarca Radio Observatory and Huancayo magnetometers are compared, and the resulting curves are used to evaluate the correlation between voice intelligibility and the magnetic field.

The radio link's geometry and configuration, as well as the simulation and correlation results are presented in this paper.